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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/707,117	11/21/2003	Cyril Cabral JR.	FIS920030252US1	1116

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INTERNATIONAL BUSINESS MACHINES CORPORATION
DEPT. 18G
BLDG. 300-482
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EXAMINER	
ROSE, KIESHA L	

ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 01/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/707,117	CABRAL ET AL.	
	Examiner	Art Unit	
	Kiesha L. Rose	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 October 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,6,7 and 11-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,6-7 and 11-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the amendment filed 17 October 2005.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1,3,11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Prior Art (Figure 1) in view of Werkhoven et al (U.S. Publication 2003/0032281).

Applicant's Prior Art discloses an interconnect structure (Fig. 1) that contains a set of active devices connected by a set of interconnect structures having at least one via extending to make direct electrical contact with another circuit element (104), in which at least some of the interconnect structures are formed by a conductive material (106) embedded in an interlevel dielectric (112), the conductive material being separated from the dielectric by at least one liner layer (130), in which said at least one liner layer is formed from a liner material comprising Tantalum and Nitrogen in an atomic concentration ratio N:Ta > 1.2 and the liner material comprises TaN_x, where X is greater than 1.2. Applicant's prior art discloses the ratio to be 1.2 and for X to be 1.2, similarly,

a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. Titanium Metals Corp. of America v. Banner, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985) Applicant's Prior Art discloses all the limitations except for the liner layer to have a thickness of 2nm or less. Whereas Werkhoven discloses an interconnect structure (Figs. 9 and 10) that contains an interconnect structure with conductive material (426) with a liner layer (432) formed of TaN formed on conductive material with a thickness of 2nm. (Page 9, Paragraph 103) The liner layer has a small thickness to occupy less trench and vias to allow for more conductive material and therefore increase conductivity. (Page 1, Paragraph 12, Page 9, Paragraph 103) Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Applicant's Prior Art by incorporating the liner layer to have a thickness of 2nm to occupy less trench and vias to allow for more conductive material and therefore increase conductivity as taught by Werkhoven. In regards to the substantially uniform chemical composition and the failure temperature greater than 730 degrees Centigrade, these limitations are product by process limitations. A *"product by process"* claim is directed to the product per se, no matter how actually made, *In re Hirao and Sato et al.*, 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also *In re Brown and Saffer*, 173 USPQ 685 (CCPA 1972): *In re Luck and Gainer*, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and *In re Marosi et al.*, 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a *"product by, all of"* claim, and not the patentability of the

process, and that an old or obvious product, whether claimed in *"product by process"* claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear. Even though product –by [-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted)."

Claims 6-7 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Prior Art in view of Chen et al. (U.S. Patent 6,784,096).

Applicant's Prior Art discloses a liner that extends over the bottom of the vias. Applicant's Prior Art discloses all the limitations except for the liner layer to have a thickness of 0.75 or less. Whereas Chen discloses an interconnect structure (Fig. 8f) that contains a dielectric (806) with a interconnect (816) formed therein with a liner layer (810) that is made of TaN and has a thickness of 0.5nm. The TaN layer is formed of a thickness of 0.5 nm to provide mechanical stability to the dielectric to enhance low dielectric stress migration and electro migration performance. (Column 17, lines 40-54) Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Applicant's Prior Art by having the liner layer to be a thickness of 0.5 nm to provide mechanical stability to the dielectric to enhance low dielectric stress migration and electro migration performance as taught by Chen. In regards to the resistivity of the liner being greater than 1000 micro Ohm-cm,

the Chen reference inherently discloses this limitation since it is stated in the resistivity is determinate on the thickness of the liner material and since the liner material is 0.5nm (which is claimed) then the resistivity of the liner would be greater than 1000 micro Ohm-cm. (Page 18, Paragraph 46 (applicant's specification))

Response to Arguments

Applicant's arguments with respect to claims 1,3,6-7 and 11-13 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kiesha L. Rose whose telephone number is 571-272-1844. The examiner can normally be reached on T-F 8:30-6:00 off Mondays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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KLR

ZANDRA V. SMITH
SUPERVISORY PATENT EXAMINER
6 January 2006